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Disentangling the share buyback puzzle: post-event insider trades

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Abstract

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JEL codes: G30, G32, G35

Key words: Insider trading, repurchase announcements, signaling, market timing

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1 Introduction

“...buybacks give executives an opportunity to take significant cash off the table, breaking the pay-performance link. SEC rules do nothing to discourage executives from using buybacks in this way. It’s time for that to change.”

[Robert J. Jackson Jr., June 11, 2018, Commissioner SEC]

Open market share repurchase (OMSR) announcements are generally associated with positive stock price movements. The corporate finance literature typically views such events as a managerial signal of equity undervaluation (e.g., Dann (1981), Vermaelen (1981), Comment and Jarrell (1991), Persons (1997), and Brav *et al.* (2005)). This asymmetric-information-based “signaling” explanation of repurchase announcements assumes no or minimal agency problems. However, investors may not see such an announcement as a credible signal of undervaluation.¹ In complete contrast to this signaling explanation of OMSR announcements, Fried (2001; 2005) claims that managers use these programs in their self-interest, and that the empirical evidence on repurchases is more consistent with his “managerial opportunism” theory – managers timing repurchase announcement and their trades around it for personal gains.

We test these competing explanations by exploring insider trading behavior both before and *after* the repurchase announcement event. In an effort to identify undervaluation signaling OMSR announcements, Babenko *et al.* (2012) suggest that investors should react to a repurchase announcement signal only if insiders also trade in the direction of their signal in advance of the

¹ This is partly because firms are increasingly relying on share repurchases as an alternative to dividends to distribute excess cash (see, e.g., Fama and French (2001), Grullon and Michaely (2002), and Skinner (2008)), and partly because open market repurchase announcements only represent managerial commitment to repurchase shares but are not a binding obligation on their part to complete the announced repurchase (Stephens and Weisbach (1998) and Chan *et al.* (2010)).

repurchase announcement, i.e., they increase their shareholdings.² However, this also creates an opportunity for insiders to “game” the market around the repurchase announcement. As insiders are not barred from trading around the event, they can potentially time the repurchase announcement to dispose of their shares at the higher *post-announcement* price (Fried (2005)).³ We contend that insiders aiming to game the market by timing their trades around a repurchase announcement will sell more shares after, then before, a repurchase announcement event. These post-announcement sales will be more profitable for insiders when the stock is less likely to be undervalued, and/or when it appreciates sharply on the repurchase announcement. We therefore expect post-announcement insider sales to be positively related to repurchase announcement returns, and negatively related to the degree of firm undervaluation consistent with opportunistic management behavior.

We next investigate the incremental informativeness of insiders’ equity trades following a repurchase announcement. We build on Babenko *et al.* (2012) and argue that insider trading behavior immediately after a repurchase announcement provides an updated and more precise signal of insiders’ perception of firm value than pre-announcement insider trades alone, and hence these should be correlated with firms’ longer-term returns.⁴ Firms with higher post-announcement insider selling should earn lower long-run returns, consistent with net selling not coinciding with undervaluation, and signaling such firms are either overvalued or fairly valued, or at the very least

² Holding additional firm equity is not only costly but also exposes already under-diversified insiders to considerable risk. Buying more equity in their firm will be particularly expensive for insiders when the stock is overpriced. Thus, it increases the cost of false signaling for insiders and hence adds credibility to their repurchase announcement as a signal of undervaluation.

³ Section 16 (b) of the Securities and Exchange Act contains a short-swing profit rule that prohibits insiders from profitably trading their firm’s shares in the short term, as it requires them to hold any purchased shares for at least 6 months. However, insiders who already own significant stock in their firm can still profit by trading these and/or other acquired shares.

⁴ The post-announcement insider trade signal is not only unbiased, as the risk of disclosure (repurchase announcement) timing by insiders is eliminated, but also reflects insiders’ updated views of firm value following the market reaction to the repurchase announcement signal.

not significantly undervalued. In contrast, greater equity retention by insiders after the repurchase announcement signals stock remains undervaluation leading to higher long-run returns. Furthermore, we expect greater long-run returns for repurchase-announcing firms when the direction of both pre- and post-announcement insider trades consistently suggest stock undervaluation.

Finally, we examine the relationship between post-announcement insider trades and firms' *actual* repurchase decisions. Firms repurchase their own shares for a variety of reasons apart from undervaluation.⁵ Higher insider equity retention following a repurchase announcement signals undervaluation, leading to greater firm repurchases to take advantage of the potential stock undervaluation. However, higher firm repurchases when insiders are net sellers points towards false signaling by executives (Fried (2005) and Chan *et al.* (2010)) or firm repurchasing for other corporate reasons apart from undervaluation.

We test these predictions using a sample of 8,945 open market share repurchase announcements between 1990 and 2012. Consistent with Fried's (2001; 2005) arguments, we find empirical evidence that insiders sell considerably more shares after the stock price increases on repurchase announcement. Net insider sales are nearly four times higher in the month following the repurchase announcement as compared to their net sales in the month preceding it. Also, in an effort to reduce the litigation risk associated with informed trading, insiders trade more passively and significantly reduce their sales before, but sell more heavily after, a repurchase announcement. In line with our prediction, our cross-sectional tests reveal that insider selling is most pronounced

⁵ Other potential reasons for repurchases mentioned in the literature include, for example: i) to distribute excess cash (Jensen (1986), Guay and Harford (2000), Jagannathan *et al.* (2000), Fatemi and Bildik (2012)), ii) as a takeover defense (Denis (1990), Brown and Ryngaert (1991) and Billett and Xue (2007)), iii) capital structure adjustments (Lie (2002), Dittmar (2000)), iv) to fund employee stock options, and to avoid dilution (Kahle (2002)). We term these "other corporate reasons" for repurchases.

within firms less likely to be undervalued, i.e., firms with low book-to-market ratios, high pre-announcement returns, high pre-announcement insider selling, and when the stock price rises sharply on the repurchase announcement i.e., high repurchase announcement returns. Although higher stock sales can be attributed to insiders' liquidity or diversification needs, our evidence generally seems more consistent with insiders opportunistically timing their trades around the repurchase announcement in their self-interest.

Both our univariate and multivariate analyses highlight that post-announcement insider trades have incremental information for investors. We find that firms in which insiders retain more equity post-buyback announcement earn 3.7% (4.7%) higher abnormal returns over the next two (three) years as compared to firms in which insiders sell down more equity. Consistent with insiders purchases being more informative than sales (e.g., Lakonishok and Lee (2001)), we find that firms with insider purchase-only transactions earn significantly higher abnormal returns of 5.2% (9%) in the two (three) year period following the repurchase announcement than firms with insider sales-only transactions. In addition we combine pre- and post-announcement insider trades' signals and find when both of these suggest that the stock is undervalued, such firms earn significantly higher long-term returns.

In summary, our insider trading results demonstrate that it is necessary to go beyond pre-announcement trades alone, and augment analysis with post-announcement insider trades to properly assess the underlying motive for a repurchase announcement, and associated firm value implications.

Finally, we investigate the relationship between post-announcement insider trades and firms' *actual* repurchase decisions. Our analysis suggests that post-announcement insider trades are better correlated with firms' *actual* repurchases compared with pre-announcement insider

trades. Interestingly, we find that insiders trade contrary to their firm, i.e., higher insider sales are associated with higher firm repurchases. This appears consistent with false signaling by insiders and does not support the stock undervaluation motive for share repurchases. However, when we break down our analysis of insider trades by their position/role we find top executives (CEO and CFO) and the firm generally trade in the same direction, i.e., their net sales are, negatively related to *actual* firm repurchases. In contrast, net sales by other insiders are positively related to *actual* repurchases by the firm. As top executives have better information on firm value compared to other insiders, higher sales by them indicate that the stock is unlikely to be undervalued, and hence the firm also repurchases fewer shares. Overall, this novel finding indicates that firms repurchase fewer shares when the top executives (CEO and CFO) are net sellers. However, when other insiders are net sellers firms repurchase more shares, possibly for other corporate reasons such as to fund employee stock option exercises and to avoid dilution (Kahle (2002)).

This paper contributes to the growing literature addressing the credibility of share repurchase program announcements as a signal of equity undervaluation. To the best of our knowledge, this is the first paper that simultaneously examines insider trades before, and *after*, an OMSR announcement. Lee *et al.* (1992) and Louis *et al.* (2010) observe insider trades around the repurchase tender offer (RTO) and find that insiders increase their purchases before, but sell more after, an RTO. However, unlike RTOs that offer a higher premium and are actually completed within a month, open market share repurchases are conventionally viewed as a weaker signaling tool than RTOs, and are important in their own right.⁷ This is because open market repurchase commitments are non-binding on part of firm management and are spread over multiple years, and hence open market repurchases are associated with lower announcement returns (Vermaelen

⁷ More than 95% of all announced repurchase programs are open market repurchases.

(1981) and Comment and Jarrell (1991)). In fact, Fried (2001; 2005) and Chan *et al.* (2010) suggest that OMSR announcements are opportunistically used by managers rather than to convey value-relevant information to investors. Similarly, Fenn and Liang (2001) and Edmans *et al.* (2018) suggest that managers with more stock options strategically time repurchase announcements to artificially increase stock prices before exercising their stock options. Moore (2020) shows an increase in share repurchases in the CEO equity vesting months and argues that repurchases are used to drive up returns associated with vesting-driven CEO equity sales. We add to this literature by directly examining managerial trading behavior both before and *after* the share repurchase announcement, and document empirically that insiders time the announcement, and their trades around it opportunistically. Hence not all OMSR announcements can be uniformly viewed as value signaling and investors need to take into account insider trading behavior in properly assessing the underlying motive of a repurchase program and its firm value implications.

This paper also adds to the literature on insider trading. Seyhun (1998), Lakonishok and Lee (2001), and Agrawal and Nasser (2012), among others, show that insider trades generate positive returns and have value-relevant information for investors. Our study provides further evidence on this topic. In particular, we highlight insider trading strategy around the repurchase announcement and further contribute by demonstrating that post-buyback announcement insider trades provide incremental information to investors in evaluating the credibility of the repurchase announcement signal, and associated firm returns as well as their *actual* repurchase decisions. Our results, in general, are more consistent with the opportunistic managerial behavior than the valuation signaling argument.

The remainder of the paper is organized as follows. Section 2 provides some background to the hypotheses explored in this study. In section 3, we describe our methodology, data and

sample selection criteria, and also report summary statistics. In section 4, we present and discuss our empirical results. We conclude in section 5.

2 Background and hypotheses

The corporate finance literature mainly follows a signaling undervaluation theory argument to explain positive share repurchase announcement as well as long-term returns following the announcement.⁸ This theory views the repurchase announcement as a managerial signal of equity undervaluation (e.g., Vermaelen (1981), Comment and Jarrell (1991), Grullon and Michaely (2004) and Barger *et al.* (2017)). Corporate executives also regard stock undervaluation as the primary motive behind the decision to repurchase their own firm's stock (Brav *et al.* (2005)). However, the financial flexibility and non-binding commitment of open market repurchase programs also affords managers the possibility to employ these opportunistically. For example, managers may intentionally mislead the market by announcing repurchase programs for their own personal gain (Fenn and Liang (2001), and Chan *et al.* (2010)).

To address this credibility puzzle of open market repurchase announcements, Babenko *et al.* (2012) borrow from the insider trading literature, and suggest that investors should respond to a stock buyback signal only if insiders trade in the direction of their signal.⁹ Specifically, they argue that by buying more equity in their own firm in advance of a repurchase announcement, insiders signal that they view their firm as undervalued, and investors should react more positively

⁸ Signaling undervaluation is not the only motivation for share repurchases. See footnote 5 for other repurchase motives. These repurchase motives are also not mutually exclusive as multiple factors affect the decision to repurchase shares.

⁹ Insider trades are often viewed as a window into management's beliefs. For example, Lakonishok and Lee (2001), Jenter (2005), Fidrmuc *et al.* (2006) and Agrawal and Nasser (2012), among others, show that insider trades provide value-relevant information to market participants regarding their beliefs on firm value and its future prospects.

to such repurchase announcements.¹⁰ Babenko *et al.* (2012) find evidence consistent with this proposition. Likewise, Cziraki *et al.* (2017) also show that pre-announcement insider trades are a good predictor of repurchase announcement returns.¹¹

However, because insiders are not legally restricted from trading in their own firm's shares after a share repurchase announcement, they can potentially time the announcement as well as their trades around the event to game the market (Fried (2005)). As such, Fried (2005) terms buyback announcements a “false signaling device” and claims that the empirical evidence on repurchases is more consistent with his managerial opportunism theory – managers using repurchase programs in their self-interest rather than as a signal of equity undervaluation. Managers in undervalued firms may announce and carry out repurchases to transfer wealth from selling shareholders to themselves, and the remaining shareholders. In cases where managers intend to sell their equity, they can announce a buyback program to dispose of their shares at a higher price.

A significant body of literature documents that managers engage in opportunistic behavior and informed trading.¹² Brockman *et al.* (2008) show that managers manipulate the flow of information around share repurchases. Managers increase the frequency and magnitude of bad (good) news in the month before (after), share repurchases. They also show that the probability of changing the information flow in this way increases with size of managerial ownership stake in

¹⁰ Buying additional equity in one's own firm is a costly and risk-increasing investment for under-diversified insiders, especially when the stock is overvalued.

¹¹ Consistent with this proposition and in line with these studies, we confirm that greater equity retention by insiders prior to repurchase announcement is positively associated with repurchase announcement returns in our sample.

¹² For example, Gosnell *et al.* (1992) find that corporate insiders sell down most of their stake in their firm in the five months preceding a bankruptcy announcement. Kim and Varaiya (2003) document that managers sell more heavily in quarters in which their firms are repurchasing shares. Yermack (2009) shows that CEOs gift stocks before significant declines in their stock prices, thereby allowing them to benefit from increased personal income tax savings.

the firm. Edmans *et al.* (2018) find that managers strategically disclose significantly more positive discretionary news in their equity vesting months, thereby allowing them to sell their stock and/or exercise options more profitably.¹³ Such behavior is consistent with management timing share repurchase disclosures in their self-interest. Similarly, Moore (2020) documents an increase in firm repurchase activity to support or boost share price in months coinciding with CEO vesting-driven equity sales.

Our study differs from these studies in that we focus on insiders' personal incentives to time the repurchase *announcement* and their trades around it to benefit in the short-term. We contribute by directly exploring insider trading both before, and *after* a share repurchase announcement. We expect insiders, announcing a repurchase program to game the market, to sell more (less) of their stock after (before) the announcement with such a trading pattern more pronounced in firms that are either overvalued or fairly valued, or at the very least not significantly undervalued, and in those firms where the share price rises sharply on repurchase announcement. Therefore, we expect post-announcement insider sales to be negatively related to the degree of firm undervaluation, and positively related to repurchase announcement returns. We test these propositions formally in hypotheses 1a and 1b:

Hypothesis 1a (H1a): Insiders sell more heavily in the month following a repurchase announcement event than before it.

Hypothesis 1b (H1b): Post-announcement insider sales are negatively related to firm undervaluation, and positively related to repurchase announcement returns.

¹³ A closer look at the distribution of share repurchase-related corporate news disclosures in their data shows that more than half of all share buyback announcements and related updates are made in the month in which managers' equity vests.

We further add to literature on insider trading strategies. We dissect and separately analyze insider trades by their direction around a repurchase announcement event. The extant literature on insider trading suggests that the informativeness of an insider trades signal depends on its direction/nature of the transaction. For example, Fidrmuc *et al.* (2006) and Agrawal and Nasser (2012) argue that insider purchases serve as a more informative signal because purchases are more costly. In line with this argument, Seyhun (1998) and Lakonishok and Lee (2001) provide evidence that the market reacts more strongly to insider purchase decisions as compared to their sales, which can be driven by other factors, such as insiders' liquidity or diversification needs rather than changes in their expectations regarding firm's future cash flows.

In this paper, we analyze both insider purchase and sale transactions around the repurchase announcement event as insiders can use both active and passive trading strategies to achieve similar economic effect. For example, insiders can increase ownership stake in their firm either by buying additional shares, i.e., trading actively, or by reducing their sales, i.e., trading passively. Similarly, following Jenter (2005) we argue that uni-directional trades – where all firm insiders trade in the same direction – provide a stronger signal compared to mixed or bi-directional trades – where firm insiders engage in both sale and purchase transactions. This is because uni-directional trades suggest consensus among firm insiders regarding their firm's true value, whereas mixed trades may represent disagreements.¹⁴

We also investigate whether post-announcement insider trades have incremental information and related to long-term returns of repurchasing firms. Prior studies document a positive long-term drift in returns of repurchase-announcing firms. However, Louis *et al.* (2010)

¹⁴ In unreported results, we find that the market does react more strongly to insider purchases, and when all insiders trade in the same direction (uni-directional trades).

document that nearly half of repurchasing firms in their sample experience negative long-run abnormal returns, suggesting that not all repurchasing firms outperform in the long-run. We propose that insider trades following a repurchase announcement may serve as a value relevant signal and related to firms' long-term returns.

In theory, the long-run returns of repurchase-announcing firms should depend on three factors: the degree of undervaluation before the repurchase announcement, the initial market reaction to the repurchase signal, and finally, the deviation of firm value from its fair value after the price adjustment. For example, the stock of an undervalued firm whose market price adjusts fully to fair value on a repurchase signal should not subsequently outperform. Similarly, no positive abnormal long-run returns should be expected for a fairly valued firm where managers announce a stock repurchase to sell their shares at a more favorable price. Post-announcement insider trades can therefore reveal insiders' true and/or updated beliefs regarding firm value and hence may help predict long-run returns. Higher insider sales following a stock repurchase announcement suggest that the firm is less likely to be undervalued, and therefore such firms should underperform those in which insiders retain a greater equity stake in their firm indicating undervaluation. Therefore, we expect higher post-announcement insider sales to be either unrelated or negatively related to the long-term returns of repurchase-announcing firms. Hypothesis 2 thus follows:

Hypothesis 2 (H2): The long-term returns of repurchase announcing firms are unrelated or negatively related to post-announcement insider sales.

Finally, we explore the relationship between insider trades and firms' *actual* repurchase decisions. Open market repurchase announcements represent a non-binding commitment and in

fact, Bhattacharya and Jacobsen (2016) note that 27% of repurchase-announcing firms in their sample do not repurchase a single share in the first fiscal year following the repurchase announcement. Although managers may repurchase for a number of reasons, they cite stock undervaluation as the primary motive behind their decision to repurchase shares (Brav *et al.* (2005)). However, Fried (2005) points out that an alternative explanation is false signaling by insiders, especially when they aim to time the market around the event. For example, insiders trading in opposite direction to their firm after announcing a repurchase, i.e., insiders selling in their personal account while repurchasing on behalf of their firm, seems incompatible with undervaluation motive for repurchases. Such an observation is more consistent with false signaling by insiders and/or firm repurchasing for other reasons apart from undervaluation (e.g., to fund employee stock option exercises and to avoid dilution (Kahle (2002))). Thus, observing insider trades following a repurchase announcement can provide valuable insights on repurchase objectives of a firm. Therefore, a negative (positive) relationship between post-announcement insider sales and firms' *actual* repurchases is consistent with an undervaluation motive (false signaling or other motives) for stock repurchases. This is an empirical question, and we add to this stream of literature by highlighting the important role played by post-announcement insider trades in determining firms' *actual* repurchase decisions and its motives. Hypothesis 3 is thus:

Hypothesis 3 (H3): Post-announcement insider trades are related to firms' *actual* share repurchase decisions.

3 Methodology, data, and summary statistics

We collect share repurchase announcement data from the Thomson Financial Security Data Company (SDC) Mergers and Acquisition database between January 1, 1990, and December 31,

2012. We restrict our repurchase announcement sample to open market share repurchases only. To address the duplicate announcement problem, we follow Chen and Wang (2012) and delete multiple repurchase announcements made by a firm within a period of two years, keeping only the first announcement in such cases.¹⁵

We acquire insider trades data from the Thomson Financials Insider Trading database. Insider trades are obtained from Form 4, which is filed with the Securities and Exchange Commission (SEC) whenever insiders make a stock sale or purchase transaction.¹⁶ Similar to Louis *et al.* (2010), we consider trades by all firm insiders in our main analysis instead of focusing only on top executives trades as any insider with private information can potentially benefit from it. Following Babenko *et al.* (2012), we only consider open market stock purchases and sales with stock accumulated via option exercises and stock grants excluded. In order to focus on economically significant trades, we delete all trades involving exchange of fewer than 100 shares. Babenko *et al.* (2012) also provide anecdotal evidence on executive litigation suggesting that insiders are more likely to be prosecuted for their sales transactions because insiders with negative private information may dispose of their shares before this becomes public knowledge and stock price drops.

Since insiders can exploit both active and passive trading strategies to achieve their desired economic outcome, we examine both their purchase and sale transactions around an open market share repurchase announcement event. Consistent with prior literature, we calculate the number of shares sold (bought) by insiders as the sum of shares sold (bought) by all insiders in a given time

¹⁵ Banyl *et al.* (2008) highlight that an announcement may appear more than once in the SDC data if the same announcement appears in different news sources on different dates.

¹⁶ The SEC requires insiders to file this form within two business days of the transaction following the SOX Act.

window, and scale it by the total number of outstanding shares.¹⁷ If no sales or purchase data are available due to a lack of trading activity, we set insider trades (sales and purchases) equal to zero. We define net sales as the difference between insider sales and purchases.

In addition to aggregate insider sales, purchases and net sales, we also derive measures of abnormal sales, abnormal purchases and abnormal net sales. We use two methods to calculate abnormal trades. First, in line with Kahle (2000), we calculate normal trades as the average monthly trades in the prior three-year period commencing 6 months before the repurchase announcement. Abnormal trades are then defined as the difference between actual insider trades and normal/expected insider trades. It is possible that insiders have equity vesting plans or need more cash at certain times of a year, so their trading activity might be more concentrated in these periods. Thus, following Agrawal and Nasser (2012), our second measure of abnormal trades controls for this time series effect by using the last year's insider trades for the same period as benchmark trading activity.

We estimate the market reaction to a repurchase announcement using stock return data from the CRSP database. We calculate event firm abnormal return as the difference between the 3-day (-1,1) buy-and-hold return of repurchase announcing firms, and the buy-and-hold return of the market. We use the daily value-weighted CRSP index return as the market return.¹⁸ For long-term abnormal returns, we follow Barber and Lyon (1997) and adopt the buy-and-hold abnormal return (BHAR) approach. The authors favor BHAR methodology because it accurately captures investor experience. The buy-and-hold abnormal return is the difference between the buy-and-hold

¹⁷ Our definition of insiders is similar to one used in the Thomson Financial Insider Trading database.

¹⁸ As an alternative, we use the 3-day cumulative abnormal return (CAR) around the event date (-1,1), which is defined as the sum of the difference between the event firm return on each day and the respective daily return of the market. The results are of course qualitatively similar.

return of the event firm and that of the market over the two-year period following the repurchase announcement, where a year is defined as 252 trading days or 12 months.

We measure the intended size of a repurchase program as the percentage of stated dollar value of the repurchase program to be spent on repurchase activity over the total market value of the firm at the beginning of the year. Our measure of stock price run-up is firms' 40-day buy-and-hold return starting four days prior to the repurchase announcement date. For other accounting data we rely on the COMPUSTAT database. All variables in the final dataset are winsorized at the 1st and 99th percentiles to mitigate the effect of any outliers.

Table 1 presents frequencies and averages of market value, book-to-market ratio, and size of announced repurchase program for our sample firms by year. Our final dataset contains 8,945 unique OMSR announcements with the highest number of announcements are made in the years 1998 and 1999. The average size of a repurchase program is slightly higher as compared to earlier studies; this is mainly due to the larger size of the repurchase programs after the global financial crisis.

Panel B of table 1 shows the number of repurchase announcements by industry classification. Manufacturing industry accounts for nearly 39% of all the repurchase announcements in our dataset. Repurchase announcements made by finance and insurance companies represent nearly one-quarter of all repurchase announcements. Given their frequency, and following earlier studies such as Chan *et al.* (2004) and Peyer and Vermaelen (2009), we include these firms in our analysis.

[Insert table 1 here]

Table 2 presents summary statistics of returns, insider trades, and other firm characteristics for our sample firms. Panel A of the table presents short-term and long-term returns. The mean 3-day buy-and-hold abnormal return (BHAR) around the repurchase announcement date (-1,1) is 2.3%, which is similar to the announcement returns reported in earlier studies such as Ikenberry *et al.* (1995) and Peyer and Vermaelen (2009) but slightly higher than those reported in later studies such as Bonaimé (2012). The mean two-year buy-and-hold abnormal return following a repurchase announcement is 10%, which supports the finding of a positive drift in returns of repurchase-announcing firms documented in earlier studies (see e.g., Ikenberry *et al.* (1995) and Peyer and Vermaelen (2009)). On average, repurchase announcing firms experience a decline in their share price before the announcement with a mean stock price run-up of -6.7%. This is consistent with the signaling motive for a share repurchase program, where managers initiate the program after a significant decline in their stock price.

Panel B of table 2 provides summary statistics on insider trades for a three-month window both before and after a repurchase announcement.¹⁹ As expected, insider sales are generally higher than purchases. For example, in the three-month trading window before a repurchase announcement insiders sell 0.154%, but purchase only 0.054% of their firm's outstanding equity. Net insider sales for the window are thus 0.098%. This difference increases to 0.127% of shares outstanding in the three-month period following an announcement, suggesting that insiders sell more heavily after the event. However, using either measure of benchmark trades described above, abnormal net insider sales are negative in the three-month trading windows surrounding a

¹⁹ One-month insider trades before and after a repurchase announcement are not reported in the table, but show a similar trading pattern and reported in subsequent analysis.

repurchase announcement. This result is consistent with insiders exercising caution and trading more passively, potentially to minimize litigation risk.

Panels C and D provide descriptive statistics of insider trades by insiders' position in the firm. Panel C relates to the CEO and CFO trades only, whereas panel D summarizes trades by all firm insiders other than the CEO and CFO. The pattern of insider trades in these panels (C and D), in general, is very similar to that of panel B. Firm characteristics are reported in panel E of the table. We measure firm size as the log of their total assets; mean and median values are very similar. Leverage is the ratio of total debt to total assets of a firm. Cash, cash flow, capital expenditures and research and development expenses are calculated as percentages of total firm assets. Tobin's Q is the ratio of market-to-book value, and volatility is the standard deviation of daily stock returns in the one-year period before a repurchase announcement. All accounting variables are derived from the fiscal year prior to a buyback announcement. Our mean sample values are comparable to those reported in Babenko *et al.* (2012).

[Insert table 2 here]

4 Results

In this section, we formally test our hypotheses using the methodology and data described above in section 3. We report the results of both univariate and multivariate analyses. The first subsection examines insider trading activity around a repurchase announcement.

4.1 Pre-announcement trades and short-term returns

We begin our analysis by confirming the earlier empirical evidence on the association between pre-announcement insider trades and the market reaction to a repurchase announcement. In

unreported results, in line with Babenko *et al.* (2012) we find that the initial market reaction to a buyback announcement is more positive when insiders retain more equity in their firm prior to announcing a repurchase program.²⁰ Consistent with the signaling argument, this suggests that the market takes into account pre-announcement insider trades in evaluating the credibility of a buyback announcement as a signal of undervaluation.

In additional analysis, we split insider trades by their direction. Fidrmuc *et al.* (2015) argue that insiders are eager to sell due to their diversification or liquidity needs and hence sell even on small mispricing. Insider purchases, on the other hand, require additional investment and are risk increasing; thus, insiders are likely to buy only after a significant price drop. Consistent with earlier studies, we find that insider sales are less informative compared to purchases and are associated with lower abnormal returns. In addition, we test whether uni-directional trades by all firm insiders serves as a stronger market signal – highlighting that all insiders hold a unanimous view regarding firm value – and is associated with stronger market reaction. We also find evidence consistent with this proposition.²¹

4.2 Market timing and post-announcement insider trades

In this section, we test our first hypothesis that managers may time a repurchase announcement to sell their personal shareholdings at a higher post-announcement price. Figure 1 provides evidence

²⁰ Average 3-day BHAR is 0.8% higher for subgroup of firms in which three-months net insider sales are below the sample mean than for firms in which these are above the mean, and the difference is highly significant. However, the mean difference in the long-term returns between the two subgroups is statistically insignificant. These findings suggest that pre-announcement insider trades mainly affect the short-term market reaction to a repurchase announcement.

²¹ In unreported results, we find that the market reacts much more positively to firms with insider purchase-only transactions compared to firms with sale-only and mixed transactions. Repurchase-announcing firms with pre-announcement purchase-only transactions earn a 3-day buy-and-hold abnormal return of 3.3%, which is highly significant and 2% higher compared to firms with insider sales-only transactions. Similarly, 3-day BHAR of insider purchase-only firms is 0.8% higher compared to firms in which insiders trade in both directions.

on this where we plot cumulative net sales by insiders around the repurchase announcement date. In line with our expectation, the figure highlights that insiders sell significantly more shares in the month following a repurchase announcement. In fact, cumulative net insider sales are nearly four times higher in the 30-day period after a repurchase announcement than their net sales in the same period before it.

[Insert figure 1 here]

Similarly, in panel A of table 3 we compare average pre- and post-announcement insider trades. Consistent with our hypothesis (H1a) that insiders can potentially time a repurchase announcement to offload their firm shareholdings, we find that insiders sell significantly more shares in the month following a repurchase announcement as compared with their sales in the month preceding it.²² The mean difference between one-month pre- and post-announcement insider sales is 3.47 basis points (0.0347% of outstanding equity) and is highly significant at the 1 percent level.

[Insert table 3 here]

In contrast, insiders also seem to purchase slightly more, on average, post-announcement. However, the difference between pre- and post-announcement insider purchases, although statistically significant, is only 0.49 basis points.²³ The net sales difference between the two periods, which is mainly due to differences in insider selling, is -2.93 basis points, which is again

²² We find a similar trading pattern when we compare three-month insider trades before, and after, a repurchase announcement. These results are not reported for brevity.

²³ Higher post-announcement insider purchases are not in line with our opportunistic timing of repurchase announcement hypothesis, but such purchases can be driven by firm insiders where the market reacts insufficiently to the buyback “signal” and stock remains undervalued. It also suggests that insiders trade on their firm valuation. Contractual and/or control reasons can also motivate insiders to purchase more shares post-repurchase announcement.

highly significant at the 1 percent level. This finding supports our hypothesis H1a and suggests that insiders time their trades around the repurchase announcement and sell down more equity following a repurchase announcement when stock price, on average, increases for such firms.

It is interesting to note that both abnormal net sales measures are significantly negative in both the pre- and post-announcement periods, highlighting that insiders reduce their trades around the repurchase announcement. Even though the aggregate level of net insider sales declines, the difference between pre- and post-announcement abnormal net insider sales measures is still negative and statistically significant. This suggests that insiders, on average, withhold their sales much more before a repurchase announcement and as a result still end up selling relatively more shares after the announcement. This result also highlights that insiders adopt a passive trading strategy, and sell fewer shares before a repurchase announcement. Such passive trading is consistent with insiders being aware of the potential litigation risk associated with their trading activity, which they therefore aim to minimize by reducing the volume of their trades.

The subsequent panels, B and C, of table 3 show the dollar values and frequency of insider trades around the repurchase announcement, respectively. Insider trading pattern in these panels seems generally consistent with insiders taking advantage of higher post-announcement prices to sell more shares by adopting a passive trading strategy. For example, the average dollar value of insider sales in the one-month period after a repurchase announcement is \$2.75 million compared to insider sales worth only \$0.35 million in the month before announcement. In panel D, we consider trades by top insiders only, i.e., the CEO and CFO. We find a similar trading pattern to that reported in panel A. CEOs and CFOs also, on average, sell down more of their shareholdings following a repurchase announcement. Like other insiders, they significantly reduce their net sales

before, but sell more shares after the market has had a chance to respond to the repurchase announcement.

4.3 Determinants of post-announcement insider sales

Prima facie, insiders are more likely to sell post-announcement when their firm's stock is either overvalued, or fairly valued, or at least not significantly undervalued. In other words, post-announcement insider sales will be especially high in firms that are less likely to be undervalued in the first place, or when any undervaluation has been eliminated as a result of a strong market reaction to the buyback "signal".²⁴ To test these predictions laid out formally in hypotheses H1a and H1b, table 4 compares mean insider trades for subsamples of firms sorted by different proxies of firm undervaluation and repurchase announcement returns.

Peyer and Vermaelen (2009), among others, approximate degree of firm undervaluation using the book-to-market ratio. Following earlier studies, we classify firms with book-to-market ratio above (below) the sample mean as value (growth) firms. Panel A of table 4 presents mean insider trades for the two subgroups of firms and reports their differences. These univariate results clearly show insiders in growth firms sell significantly more, and buy fewer shares in the month following a repurchase announcement. A similar pattern is observed when we compare three-month insider trades around a repurchase announcement. These findings support hypothesis H1b and show that insiders sell significantly more shares after announcing a repurchase program, especially in firms which are less likely to be undervalued. In panel B we sort repurchase-announcing firms into subsamples by their stock price run-up. Firms experiencing a significant decline in their share price are more likely to be undervalued. We find a similar trend as in panel

²⁴ Fried (2005) suggests that managers may use repurchase announcements to artificially boost share price so that they can sell their equity holdings at a higher price.

A, and find that insiders sell substantially more shares in firms which do not experience a significant decline in their share price prior to repurchase announcement.

To further test the robustness of our findings, in panel C we partition our sample data on 6-month insider trades before a repurchase announcement. Babenko *et al.* (2012) suggest that these pre-announcement insider trades signal their views on firm valuation and hence can serve to proxy firm undervaluation. We classify firms as undervalued in which insiders retain greater equity in their firm, i.e., with net insider sales below the sample mean. Similar to panels A and B we find evidence that insiders sell more heavily post-announcement in firms that are less likely to be undervalued.

In panel D of table 4, we partition our sample data on the basis of repurchase announcement returns i.e., 3-day buy-and-hold abnormal returns. Firms with 3-day BHAR above (below) the sample mean are classified to the high (low) return subgroup. Consistent with Fried's (2005) argument that insiders can potentially time repurchase announcement to cash out at higher stock prices, we find that insiders sell more shares when their stock price appreciates sharply on repurchase announcement. Overall, the findings in table 4 support our hypothesis H1b. Post-announcement insider sales are substantially higher in firms that are less likely to be undervalued and when the market responds more favorably to the buyback "signal".

[Insert table 4 here]

The analysis above highlights that insider sales following a repurchase announcement depend upon both the degree of firm undervaluation and the market response to the share

repurchase announcement signal.²⁵ In table 5, we control for the market reaction to the repurchase signal and analyze the effect of firm characteristics on post-announcement insider sales. Table 5 reports mean net insider sales for two-way sorted subsamples of firms. First, each year we rank repurchase-announcing firms into two subgroups by their short-term repurchase announcement returns. Firms in each subgroup are then split into two subgroups by book-to-market ratio, size, and volatility in panels A, B and C, respectively.²⁶ Panel A of table 5 shows that controlling for repurchase announcement returns, insiders in growth firms sell significantly more shares post-announcement as compared to insiders in value firms, providing further evidence on our hypothesis H1b.

To test whether insiders' private information is more valuable and can lead to greater gains in firms that suffer from a higher degree of information asymmetry, we follow Corwin (2003) and Zhang (2006) and use firm size proxy for the degree of information asymmetry between insiders and investors. These papers, among others, argue that smaller firms suffer from a higher degree of information asymmetry because they receive little media coverage and are followed by fewer analysts. Lakonishok and Lee (2001) also show that potential profits from insider trading are higher in the case of smaller firms than in larger firms as smaller firms are less efficiently priced due to higher information asymmetry. These findings lead to the speculation that insiders in smaller firms are more likely to trade opportunistically around repurchase announcements and will sell down more of their stock holdings after a repurchase announcement compared to insiders in larger firms. In panel B of table 5 we find evidence that smaller firm insiders sell significantly

²⁵ For undervalued firms, post-announcement insider sales partly depend upon how quickly and accurately the market adjusts to the firm's fair value in response to the buyback (undervaluation) signal. Any undervaluation is more likely to have been eliminated or significantly reduced when the initial market reaction is more positive, and therefore, insiders in such firms sell more shares post-announcement, as evidenced in panel D of table 4.

²⁶ Sorting on these firm characteristics is based on mean values. For example, firms with size above (below) the sample mean are classified as large (small) firms.

more shares after announcing a repurchase program. This is especially true for firms that experience greater price appreciation on repurchase announcement. For such firms, the mean difference in one-month (three-month) net insider sales between smaller and larger firms is 1.95 (4.94) basis points and is statistically significant at the 5 percent level.

Babenko *et al.* (2012) argue that it is riskier for undiversified insiders to hold more equity in their firm when stock volatility is high. Therefore, insiders in risky firms may sell more of their firm stock holdings to diversify risk. However, as shown in panel C, we do not find any significant difference in net insider sales between high and low volatility firms. This result suggests that stock volatility may not be the most important factor for insiders in their stock sell-down decisions and insiders may not be motivated to sell simply for diversification reasons – firm value is a more important consideration in determining their stock sell-down decisions.

[Insert table 5 here]

In table 6, we test hypothesis H1b using a multivariate approach. We regress net insider sales in the one-month period post-buyback announcement on short-term announcement returns, pre-announcement insider trades, and their interactions in different model specifications.. Consistent with our hypothesis we find that insiders sell more when the market reacts more positively to a repurchase announcement, and when the firm is unlikely to be undervalued. For example, a one-percentage-point increase in 3-day BHAR is associated with a 0.28% increase in net insider sales in the month following a repurchase announcement. Similarly, the positive association between pre- and post-announcement net insider sales variables suggests that insiders sell more shares after a repurchase announcement when the stock is unlikely to be significantly undervalued, as signaled by higher pre-announcement insider sales.

In column 2, we regress post-announcement net insider sales on the interaction term between repurchase announcement returns and pre-announcement net insider sales. The positive coefficient on the interaction term signifies that insiders are further motivated to sell-down more of their stock when the firm is unlikely to be undervalued and its price also increases sharply on repurchase announcement. Since potential profits are higher for this subset of repurchase announcing firms, insiders exploit the opportunity and sell down more of their shareholdings. However, the coefficient on the interaction term between repurchase announcement returns and pre-announcement purchase-only transactions is negative, although insignificant (column 3). This suggests that the market reacts insufficiently to repurchase announcement of an undervalued firm. Even though short-term returns for such firms are higher, on average, but the adjustment is insufficient. As a result, insiders continue to hold their shares in these firms.

[Insert table 6 here]

In column 4, we find a positive and highly significant coefficient on the interaction term between repurchase announcement returns and firms with pre-announcement insider sales-only transactions. This provides further evidence that even when insiders share a unanimous view that their stock is unlikely to be undervalued, they may still time the repurchase announcement to sell more profitably, benefitting from increase in price of their stock associated with repurchase announcement. This highlights that investors can sometimes misinterpret non-signaling repurchase announcements as positive signals thereby allowing insiders to sell-down their equity at higher post-announcement prices. In column 5, the negative coefficient on the interaction term between repurchase announcement returns and firms with mixed transactions in the pre-announcement period suggests that insiders sell fewer shares post-announcement when they disagree on firm valuation. The evidence presented above thus highlights that managers can potentially time a

repurchase announcement in their self-interest and cash out at higher stock prices instead of using this to convey their optimism about a firm's future performance, as suggested by Fried (2001; 2005).

4.4 Post-announcement insider trades and long-term returns

Next, we explore the relationship between post-announcement insider trades and the long-run returns of repurchase-announcing firms, more formally stated in our hypothesis 2. Higher equity retention by insiders following a repurchase announcement signals that the firm's stock remains underpriced and should earn higher long-run returns and vice versa. In table 7, we present average long-term returns for different subsamples of repurchase-announcing firms ranked by the magnitude of insider sales in the month post-announcement. In line with hypothesis 2, we find that firms with lower net insider sales post-announcement tend to do better in the long-term. The mean two- and three-year BHARs for such firms are 3.7% and 4.7% higher, respectively, compared to firms in which insiders sell more of their firm's stock. We find a similar long-term return pattern for the two subgroups when we only consider CEO and CFO trades, except that the effect is stronger and lasts only in the first two years following the announcement.

[Insert table 7 here]

In table 8, we investigate the effect of the direction of post-announcement insider trades on the long-term returns of repurchase-announcing firms. Consistent with earlier studies, we find that insider purchases are more informative, and firms with insider purchase-only transactions earn higher long-term returns compared to firms with insider sales-only transactions. For example, the mean two- (three-) year buy-and-hold abnormal return for firms in which insiders purchase more equity (purchase-only transactions) is 5.2% (9%) higher than firms in which they only sell (sales-

only transactions) following the repurchase announcement. Although there is no significant difference in the mean returns between firms with purchase-only and firms with mixed (both buy and sell) transactions, we find that firms with mixed transactions outperform firms with sales-only transactions in the long-run, as expected.

[Insert table 8 here]

A further contribution of this paper to the insider trading literature is that our data allows us to analyze the combined effect of the signals conveyed by both pre- and post-announcement insider trades. The post-announcement insider trades signal can either complement or contradict the pre-announcement insider trades signal. We expect long-term returns to be higher for repurchase-announcing firms when pre-announcement insider trades signal stock undervaluation and the post-announcement insider trades confirm this signal, i.e., the stock remains undervalued even after taking into account the price adjustment on repurchase announcement.

To test this expectation, table 9 compares mean buy-and-hold abnormal returns for subgroups of firms in which insiders trade in the same direction in the one-month before, and after, the repurchase announcement. High (Low) subgroups represent firms with high (low) levels of net insider sales in both the pre- and post-announcement periods. As expected, we find that firms earn a higher long-term return when both pre- and post-announcement insider trading behavior consistently signal firm undervaluation. Specifically, such firms earn an average return of 11.2% (17.4%) above the market return in the two (three) year period following the announcement which is approximately 7% (10%) higher than the BHAR for firms with greater insider sales.

[Insert table 9 here]

To explore these results in more detail, we conduct multivariate analysis in table 10. Specifically, we regress the long-term returns (two-year BHAR) of repurchase-announcing firms on the post-announcement insider trades (columns 1 and 2) and the consistency of insider trades signal in both pre- and post-announcement periods (columns 3 and 4). In order to remove the effect of outliers, we use dummy variables to represent insider trades. For example, our high net sales dummy variable takes the value of 1 for firms in the high net insider sales subgroup and 0 otherwise. The net insider sales subgroups are formed based on three-month (columns 1 and 3) and one-month trading windows (columns 2 and 4).

[Insert table 10 here]

As table 10 shows, three-month post-announcement insider trades are not significantly related to long-term returns. However, insider sales immediately after a repurchase announcement are significantly negatively related to long-term returns at the 10% level. Columns 3 and 4 take into account insider trades both before and after a repurchase announcement. Here, the dummy variable takes the value of 1 when both pre- and post-announcement net insider sales are above the sample mean, i.e., insider trades are consistent in suggesting that the stock is less likely to be undervalued, and 0 otherwise. A negative and significant coefficient on these variables, particularly in the one-month trading window case, suggests that firms with higher net insider sales around the repurchase announcement earn lower long-term returns. In fact, such information contained in insider trades appears to be incremental to, and not captured by, other proxies of undervaluation in our regression models.

4.5 Post-announcement insider trades and actual repurchases

Finally, we explore the value relevance of post-announcement insider trades in explaining the *actual* repurchase behavior of firms that announce an OMSR program. Because such repurchase announcements only represent the managerial intention to repurchase shares and are not binding obligations, completion rates vary greatly among firms. Managers may repurchase shares on their firm's account either to take advantage of stock undervaluation (Vermaelen (1981) and Ikenberry *et al.* (1995)) or for other corporate objectives. Babenko *et al.* (2012) show that pre-announcement insider purchases increase repurchase completion rates, which is consistent with such purchases signaling firm undervaluation. However, it is also necessary to take into account what insider trades suggest about firm value *after* the market has had the opportunity to react to the repurchase signal.

Specifically, we test whether post-announcement insider trades are related to, and can explain repurchase program completion rates, as stated in hypothesis 3. Similar in spirit to Babenko *et al.* (2012), we expect higher post-announcement net insider sales to be negatively related to repurchase completion rates, which would suggest that the firm is unlikely to be undervalued, and hence the firm should repurchase fewer shares as well. Such an evidence on lower *actual* completion rates while insiders are selling is also consistent with false signaling by executives. However, managers in such firms may still repurchase shares for reasons other than undervaluation and false signaling. Table 11 tests these competing explanations for *actual* repurchase completion rates in different regression model specifications. Following Stephens and Weisbach (1998) and Babenko *et al.* (2012) we define actual repurchase completion rate as the sum of monthly reductions in the number of shares outstanding (without offsetting them with monthly increases) in the 12-month period after a repurchase announcement. Next, we divide this

sum by the number of shares outstanding at the time of share buyback announcement. Finally, the percentage completion rate is derived as the ratio of actual repurchases to intended repurchase program size. We control for other determinants of actual repurchases in our regression specifications and include industry and year fixed effects.

[Insert table 11 here]

In columns 1 and 3 of table 11, we regress *actual* repurchase completion rate on net insider sales in the one- and three-month periods after a repurchase announcement, respectively. The positive and highly significant coefficient on the net insider sales variable in both specifications indicates that *actual* repurchase completion rates are higher for firms in which insiders sell more shares. For example, a one-standard-deviation change in three-month net insider sales increases the repurchase completion rate by 3.23%. This positive relationship suggests that insiders often trade in the opposite direction to their firm, and such evidence, though consistent with the findings of Bonaimé and Ryngaert (2013), is puzzling in a signaling context.

However, upon further analysis, an interesting finding emerges when we split insider trades by their role in the firm. Arguably, top executives (the CEO and CFO) have better information and can value their firm more accurately compared to other insiders. Thus, it is reasonable to assume that CEO and CFO trades are more likely to be driven for undervaluation reasons. To test this proposition, in columns 2 and 4 of the table we regress repurchase completion rates on the CEO and CFO net sales and the net sales by other insiders separately in the one- and three-month trading windows, respectively. The coefficient on the CEO and CFO net sales variable is negative and highly significant, whereas the coefficient on other insiders' net sales variable is positive and highly significant. These results highlight that when top executives are net sellers after a

repurchase announcement, then repurchase completion rates decline for such firms – a result that is consistent with both false signaling by insiders as well undervaluation motive for firm repurchases, i.e., firm repurchasing fewer shares when top executives sell down their equity signaling the stock is unlikely to be undervalued.

In contrast, higher sales by other insiders increase firms' repurchase completion rates. Top executives in such firms may repurchase more on their firms' behalf for other corporate reasons while other insiders are selling down their personal stock holdings in their own firm.²⁷ Finally, in columns 5 and 6 of table 11 we include both pre- and post-announcement insider trades in our regression model. We observe highly significant coefficients on the post-announcement insider trades variables in both models suggesting that post-announcement insider trades are better correlated with firms' *actual* repurchases as compared with pre-announcement insider trades.

In summary, our analyses highlight that insiders often trade contrary to their firm following the repurchase announcement. The observation is inconsistent with undervaluation motive of share repurchases and points towards opportunistic timing of repurchase announcement by insiders. Moore (2020) also documents that firm repurchases increase when managers are selling their equity. However, our study differs from his work as we focus on the timing of repurchase *announcement* where as he looks at the timing of actual firm repurchases. In addition, incremental to Bonaimé and Ryngaert (2013), our findings advocate that to understand the objective of firms' *actual* repurchases, investors should take into account not only the insiders' trading behavior following the repurchase announcement but also who is trading.

²⁷ It is also possible that managers repurchase more shares in their firms' account to provide additional price and liquidity support while they are selling down their own shares to allow them to trade more profitably.

5 Conclusion

Open market share repurchase programs lack the characteristics of a credible signal. Babenko *et al.* (2012) assess the credibility of such buyback announcements by analyzing the trading behavior of firm insiders prior to the event. However, insiders can also potentially use repurchase announcements to game the market around the event for personal gain. Therefore, in this paper, we argue that in addition to pre-announcement insider trades, it is important to analyze the trading behavior of firm insiders *post* the repurchase announcement, not just before. Compared with pre-announcement trades, post-announcement insider trades can provide a cleaner measure of insiders' views on firm value. In particular, the post-announcement insider trades signal is not biased by insiders' timing of the repurchase announcement, and also takes into account changes to insiders' views on firm value following the market reaction to the repurchase announcement signal.

In this paper, we find that the market does react more favorably to repurchase announcements when insiders retain more equity in the firm prior to the repurchase announcement. However, consistent with insiders potentially timing the repurchase announcement, we find that insiders, on average, sell more shares after announcing a repurchase program. Insiders sell down considerably more when the market reaction to the repurchase announcement is more positive and when all insiders appear uniformly to believe that the firm is unlikely to be undervalued. Most importantly, our findings indicate that post-announcement insider trades can predict the long-term returns of repurchase-announcing firms, an issue not explored in the literature to date to our knowledge. We empirically document higher long-term returns for firms in which both pre- and post-announcement insider trades consistently suggest that the firm is undervalued.

Finally, we provide evidence that insider trades after a repurchase announcement can also better explain the *actual* repurchase behavior of repurchase-announcing firms compared with pre-announcement insider trades. The market can thus benefit by taking into account the information content of insider trades around a repurchase announcement when assessing the credibility of the repurchase signal to better understand the motive(s) behind open market share repurchases which as our evidence suggests can be initiated for opportunistic reasons by firm management.

In line with managerial opportunism theory of repurchases by Fried (2001; 2005), in this study we empirically document that insiders time the disclosure of, and their trades around, a repurchase announcement to trade more profitably in their personal account. Our results highlight that it is important to take into account *post* announcement insider trades along with pre-announcement insider trades to properly assess the underlying motive for a repurchase announcement, and associated firm value implications.

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Figure 1: Cumulative net insider sales relative to repurchase announcement day

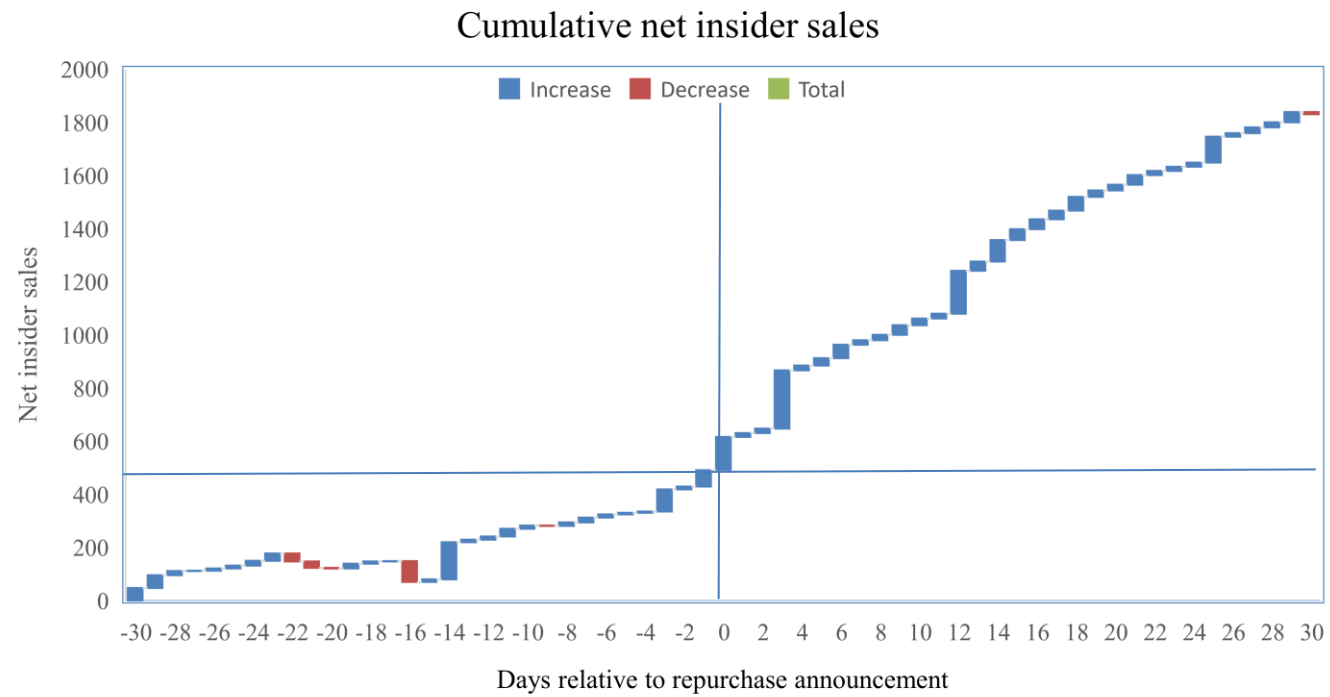


Table 1: Distribution of repurchase announcements by year and industry

This table reports the distribution of repurchase announcements by year and industry. Panel A reports the distribution by year. Year is the fiscal year in which the repurchase announcement is made. Frequency counts the number of open market repurchase programs announced in a given year. Book-to-market is the ratio of the book value of assets to the market value at the beginning of the fiscal year. Market value is the average market value of firms in millions of dollars. Intended percentage is the percentage of outstanding shares that management intends to repurchase at the time of the announcement.

Panel B reports the distribution of repurchase announcements by industry. Industries are classified based on two-digit Standard Industrial Classification (SIC) codes in COMPUSTAT.

Panel A: Distribution of repurchase announcements by year.

Year	Frequency	Book-to-market	Market value (\$m)	Intended percentage
1990	433	0.84	898.85	7.32
1991	114	0.86	1223.93	8.59
1992	215	0.61	1498.94	7.35
1993	240	0.59	1651.03	5.85
1994	446	0.65	1378.79	6.14
1995	421	0.68	1384.05	6.99
1996	559	0.58	2264.09	6.46
1997	488	0.54	1787.50	7.23
1998	866	0.65	1803.72	8.34
1999	635	0.73	1819.54	8.02
2000	372	0.78	3837.12	9.03
2001	361	0.67	6959.89	8.37
2002	250	0.74	3917.20	8.77
2003	253	0.60	4313.64	7.94
2004	311	0.48	6314.72	8.51
2005	360	0.47	6983.02	8.02
2006	354	0.47	9137.10	8.48
2007	522	0.57	7084.00	9.21
2008	556	0.74	3543.54	9.90
2009	182	0.77	5204.74	9.73
2010	300	0.62	6745.56	10.00
2011	426	0.62	5842.62	10.08
2012	281	0.69	8051.59	11.18
All	8945	0.64	3854.37	8.26

Panel B: Distribution of repurchase announcements by industry

Industry	Frequency	Percent	Cumulative frequency	Cumulative percentage
Agriculture, forestry, and fishing	21	0.23	21	0.23
Construction	100	1.12	121	1.35
Finance and insurance	2205	24.65	2326	26.00
Manufacturing	3486	38.97	5812	64.97
Mining	200	2.24	6012	67.21
Public administration	28	0.31	6040	67.52
Retail trade	644	7.2	6684	74.72
Services	1419	15.86	8103	90.59
Transportation and communication	537	6	8640	96.59
Wholesale trade	305	3.41	8945	100.00

Table 2: Summary statistics of repurchase announcing firms

The table reports summary statistics for firms that announced an open market share repurchase program during the sample period. The table presents the number of observations (N), mean, standard deviation (SD) and 1st, 50th and 99th percentiles of different variables. Panel A reports announcement and long-term post-announcement return statistics (in percentages). 3-day CAR (BHAR) is the 3-day (-1,1) cumulative (buy-and-hold) abnormal return around the announcement date (day 0) using the value-weighted market return as the benchmark. 2-year BHAR is the two year (24 month) buy-and-hold abnormal return of repurchase-announcing firms using the CRSP value-weighted market return as the benchmark. Stock price run-up is the 40-day (-44, -4) buy-and-hold return of event firms starting 4 days prior to the repurchase announcement to -44 days.

Panel B reports summary statistics on insider trades around the repurchase announcement. (-3-month) +3-month sales (purchases) is the number of shares sold (bought) by insiders in the 3-month period (before) after the repurchase announcement normalized by the number of shares outstanding and multiplied by 10,000. +3-month (-3-month) net sales is the difference between the number of shares sold and the number of shares bought by insiders in the 3-month period post- (pre-) announcement normalized by the number of outstanding shares and multiplied by 10,000. +3-month (-3-month) abnormal net sales is the difference between net insider sales in the 3-month window before (after) the announcement and the net insider sales in the same time period last year based on Agrawal and Nasser (2012). +3-month (-3-month) abnormal net sales 2 is the difference between net insider sales in the 3-month window before (after) the repurchase announcement and the normal net insider sales for the firm during the same time window (number of months), where the normal net insider sales are measured as the average monthly difference in the number of shares sold and the number of shares bought by firms' insiders in the previous three-year period starting six months before the repurchase announcement, following a methodology similar to Kahle (2000). All trades are normalized by the number of outstanding shares and multiplied by 10,000. -3-month (+3-month) \$ purchases (sales) is the dollar value of insider purchases (sales) in millions in the 3-month window before (after) the repurchase announcement.

Panels C and D differentiate insider trades by insiders' position in the firm. Summary statistics on the CEO and CFO trades are reported in Panel C, and Panel D presents summary statistics on insider trades by all other insiders except the CEO and CFO. Insider trade variables in both panels C and D are defined as in panel B. Panel E provides summary statistics on other firm characteristics. Firm size is the log of the book value of assets. Leverage is the ratio of total debt to total firm assets. Book-to-market is the ratio of the book value of firms' assets to its market value. Cash is the cash and cash equivalents scaled by total assets. Cash flow is operating income before depreciation divided by the book value of assets. Capital expenditure (R&D expense) is the capital expenditures (research and development expenditure) scaled by the book value of assets. Cash, cash flow, capital expenditure and R&D expense are shown as percentages. Tobin's Q is the ratio of the market-to-book value of assets. Return volatility is the standard deviation of daily stock returns measured over the one-year period prior to the repurchase announcement.

Variables	N	Mean	SD	Percentiles		
				1st	50th	99th
Panel A: Returns (percentages)						
CAR	8945	2.4	7.9	-23.0	1.8	31.0
3-day BHAR	8945	2.3	7.7	-22.6	1.6	30.3
5-day BHAR	8945	2.2	8.8	-25.1	1.6	33.1
2-year BHAR	8945	10.0	74.8	-124.6	-0.1	338.8
Stock price run-up	8942	-6.7	17.8	-57.5	-4.9	41.2
Panel B: Insider trades						
-3-month Sales	8945	15.413	54.35	0	0	426.71
-3-month Purchases	8945	5.369	22.558	0	0	169.36
-3-month Net Sales	8945	9.787	56.338	-156.83	0	409.12
-3-month Abnormal Net Sales	8945	-10.462	104.305	-677.34	0	292.21
-3-month Abnormal Net Sales 2	8945	-8.821	77.636	-383.19	-0.576	265.17
-3-month \$ Purchases (millions)	8945	0.3155	4.78711	0	0	3.8821
-3-month \$ Sales (millions)	8945	4.0627	54.4533	0	0	53.584
+3-month Sales	8945	18.808	69.422	0	0	562.55
+3-month Purchases	8945	5.301	22.033	0	0	172.72
+3-month Net Sales	8945	12.716	65.577	-144.33	0	492.51
+3-month Abnormal Net Sales	8945	-11.764	124.573	-785.1	0	372.82
+3-month Abnormal Net Sales 2	8945	-5.892	86.078	-375.48	-0.415	360.56
+3-month \$ Purchases (millions)	8945	0.477	8.12652	0	0	5.0223
+3-month \$ Sales (millions)	8945	4.385	53.4177	0	0	55.165
Panel C: CEO & CFO trades						
-3-month Sales	8945	1.919	8.215	0	0	59.787
-3-month Purchases	8945	0.479	2.661	0	0	21.614
-3-month Net Sales	8945	1.399	8.373	-20.482	0	57.121
-3-month Abnormal Net Sales 2	8945	-0.32	9.019	-34.067	0	41.992
+3-month Sales	8945	1.849	7.764	0	0	56.761
+3-month Purchases	8945	0.356	1.886	0	0	15.06
+3-month Net Sales	8945	1.468	7.779	-13.39	0	55.125
+3-month Abnormal Net Sales 2	8945	-0.251	8.943	-34.53	0	43.043
Panel D: Other Insider trades						
-3-month Sales	8945	12.294	45.827	0	0	367.02
-3-month Purchases	8945	4.298	18.909	0	0	146.25
-3-month Net Sales	8945	7.845	47.286	-130.9	0	348.87
-3-month Abnormal Net Sales 2	8945	-8.837	70.662	-369.68	-0.462	213.63
+3-month Sales	8945	15.765	60.902	0	0	489.49
+3-month Purchases	8945	4.359	18.636	0	0	145.92
+3-month Net Sales	8945	11.024	59.457	-121.42	0	456.82
+3-month Abnormal Net Sales 2	8945	-5.659	80.341	-363.83	-0.353	327.36
Panel E: Firm Characteristics						
Firm size	8945	2.783	0.871	0.979	2.742	5.088
Leverage	8919	0.538	0.258	0.068	0.532	0.973
Book-to-Market	8900	0.644	0.44	0.058	0.546	2.511
Cash	8945	16.153	18.339	0.091	8.282	77.274
Cash flow	8859	12.119	11.055	-25.717	12.05	47.745
Capital expenditures	8945	4.576	5.438	0	3.017	29.964
R&D expense	8945	2.646	5.089	0	0	24.361
Tobin's Q	8900	2.607	2.567	0.398	1.833	17.371
Return volatility	8942	0.029	0.015	0.009	0.025	0.087

Table 3: Insider trades around repurchase announcement

This table compares pre- with post-repurchase announcement insider trades. 1-month trades refer to average insider trades in the month before (Pre), and after (Post), the repurchase announcement. Insider trade variables are as defined in table 2 except that insider trade variables are calculated for a month instead of 3-month period around the repurchase announcement event. The diff column reports the mean difference between pre- and post-announcement insider trades. Significance of the difference in means is tested using t-statistics, and the associated p-values are reported in the table.

Shares traded	1-Month trades			
	Pre	Post	Diff	P-value
Panel A: Insider trades				
Sales	2.93	6.40	-3.47***	0.00
Purchases	1.52	2.00	-0.49***	0.00
Net sales	1.37	4.33	-2.96***	0.00
Abnormal net sales	-3.39	-1.92	-1.47***	0.00
p-value	0.001	0.001		
Abnormal net sales2	-4.84	-1.88	-2.96***	0.00
p-value	0.001	0.001		
Panel B: Dollar value of trades				
Sales value	0.35	2.75	-2.39***	0.00
Purchases value	0.03	0.18	-0.15***	0.00
Abnormal sales value	-0.36	0.20	-0.56	0.29
p-value	0.00	0.70		
Abnormal purchase value	0.007	0.039	-0.03	0.53
p-value	0.00	0.44		
Panel C: Trade frequency				
Sale frequency	1.11	2.86	-1.75***	0.00
Purchase frequency	0.44	0.83	-0.39***	0.00
Abnormal sales freq.	-0.51	-0.83	0.32	0.34
	0.00	0.02		
Abnormal purchase freq.	0.157	0.358	-0.2**	0.02
	0.00	0.00		
Panel D: CEO and CFO trades				
Sales	0.29	0.59	-0.3***	0.00
Purchases	0.13	0.16	-0.03**	0.02
Net sales	0.15	0.43	-0.28***	0.00
	-			
Abnormal net sales	0.420	-0.145	-0.28***	0.00
p-value	0.001	0.001		

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Table 4: Post-announcement insider trades of repurchasing firms in subsamples

This table reports post-announcement one-month and three-month mean insider trades for different subsamples. Panels A, B and C divide our sample firms into high and low subgroups based on their book-to-market ratio, stock price run-up and pre-announcement 6-month net sales, respectively. High (low) subgroups in panels A, B and C are made up of firms with a book-to-market ratio, stock price run-up and 6-month pre-announcement net sales above (below) the sample mean, respectively. Finally, Panel D classifies the sample firms based on their three-day (-1, 1) repurchase announcement return into high and low announcement (Ann.) return subgroups. Firms with three-day BHARs above (below) the sample mean are included in High (Low) announcement return subgroup. Insider trade variables are as defined in tables 2 and 3 and calculate 1-month trades similarly. The difference in means between subgroups for each panel is reported in the Diff column. The significance of difference in mean insider trades between subgroups is tested using the t-test. P-values associated with the t-statistics are also reported in the table.

Variables	Panel A: Book-to-Market ratio				Panel B: Stock price Run-up			
	Low	High	Diff	P-value	High	Low	Diff	P-value
1-month Sales	7.43	4.83	2.60***	0.0001	7.45	5.14	2.31***	0.0001
1-month Purchases	1.66	2.52	-0.86***	0.0001	1.43	2.69	-1.26***	0.0001
1-month Net sales	5.69	2.26	3.43***	0.0001	5.96	2.37	3.59***	0.0001
3-month Sales	21.32	15.00	6.32***	0.0001	20.41	16.89	3.52**	0.017
3-month Purchases	4.32	6.79	-2.47***	0.0001	3.89	6.99	-3.1***	0.0001
3-month Net sales	15.95	7.81	8.14***	0.0001	15.66	9.2	6.46***	0.0001
Variables	Panel C: Pre-announcement 6m Net Sales				Panel D: Ann. Return (3-day BHAR)			
	High	Low	Diff	P-value	High	Low	Diff	P-value
1-month Sales	15.61	4.4	11.21***	0.0001	7.44	5.57	1.87***	0.0001
1-month Purchases	1.61	2.09	-0.48**	0.0313	1.97	2.03	-0.06	0.778
1-month Net sales	13.85	2.27	11.58***	0.0001	5.43	3.45	1.98***	0.000
3-month Sales	43.58	13.45	30.13***	0.0001	20.82	17.21	3.61**	0.015
3-month Purchases	4.81	5.41	-0.60	0.3225	5.46	5.17	0.29	0.537
3-month Net sales	36.98	7.47	29.51***	0.0001	14.3	11.46	2.84**	0.041

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Table 5: Two-way sorted subsamples of repurchasing firms

This table reports average 1-month and 3-month post-announcement net insider sales for subsamples sorted on two variables. Vertically, each year sample firms are ranked into two subgroups based on repurchase announcement return. Low (high) rank refers to subgroup of firms that have lower (higher) announcement returns. Horizontally, within each announcement return subgroup, firms are further sorted into two subgroups based on book-to-market ratio, firm size and return volatility in panels A, B and C, respectively. High (low) subgroups include firms with book-to-market ratio above (below) the sample mean. In panel B, Small (large) refers to subgroup of firms with firm size below (above) the sample mean. In panel C, the high (low) subgroup contain firms with stock return volatility above (below) the sample mean. Insider trade variables are as defined in tables 2, 3 and 4. The Diff column reports mean differences between the subgroups. The significance of difference in mean insider trades between subgroups is tested using the t-test. P-values associated with the t-statistics are also reported in the table.

Ann. Return Rank	Panel A: Book-to-market				
	Variable	Low	High	Diff	P-value
Low	1-month Net sales	4.47	1.65	2.82***	0.0004
	3-month Net sales	14.76	6.32	8.44***	0.0001
high	1-month Net sales	7.02	2.79	4.22***	0.0001
	3-month Net sales	17.25	9.13	8.11***	0.0001
Ann. Return Rank	Panel B: Firm size				
	Variable	Small	Large	Diff	P-value
Low	1-month Net sales	3.45	3.38	0.06	0.9332
	3-month Net sales	14.12	9.39	4.73**	0.0147
high	1-month Net sales	6.07	4.12	1.95**	0.0234
	3-month Net sales	15.95	11.00	4.94**	0.0138
Ann. Return Rank	Panel C: Return volatility				
	Variable	high	low	Diff	P-value
Low	1-month Net sales	3.37	3.43	-0.06	0.9378
	3-month Net sales	13.13	10.82	2.30	0.2598
high	1-month Net sales	5.16	5.30	-0.15	0.8639
	3-month Net sales	15.29	12.65	2.65	0.1851

Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Table 6: Determinants of post-announcement trades

This table reports the results of regressions of post-announcement insider sales on repurchase announcement returns, pre-announcement insider trades and other control variables. The dependent variable in all models is net insider sales in the 1-month window post-announcement. Model 2 includes the interaction term between repurchase announcement returns and 3-month net insider sales in the pre-announcement period. Model 3 includes the interaction term between repurchase announcement returns and 3-month purchase-only transactions in the pre-announcement period. Model 4 includes the interaction term between repurchase announcement returns and 3-month sale-only transactions in the pre-announcement period. Model 5 includes the interaction term between repurchase announcement returns and 3-month mix transactions – where insiders engage in both purchase and sale transactions – in the pre-announcement period. T-statistics are in parenthesis. Regression models also include year and industry fixed effects along with other control variables. Announcement return is the 3-day (1, 1) buy-and-hold abnormal return around the repurchase announcement date (day 0). The other variables are as defined in table 2.

Variables	1	2	3	4	5
Intercept	5.89 (0.91)	5.89 (0.91)	5.74 (0.88)	5.91 (0.91)	6.13 (0.94)
Announcement return (AR)	28.54*** (7.57)	27.21*** (7.15)	31.20*** (7.5)	17.95*** (4.09)	38.78*** (7.42)
net sales -3m	0.08*** (16.03)	0.08*** (14.76)	0.08*** (15.78)	0.08*** (15.6)	0.08*** (16.08)
AR x net sales-3m		0.13** (2.46)			
AR x pur only -3m			-13.06 (-1.52)		
AR x sale only -3m				37.69*** (4.68)	
AR x mix -3m					-19.90*** (-2.83)
Stock price run-up	16.02*** (9.23)	16.07*** (9.26)	16.02*** (9.23)	16.21*** (9.35)	16.13*** (9.3)
Book to-market ratio	-1.23 (-1.35)	-1.21 (-1.34)	-1.2 (-1.33)	-1.12 (-1.24)	-1.21 (-1.33)
Size	-0.47 (-1.06)	-0.49 (-1.09)	-0.48 (-1.08)	-0.56 (-1.25)	-0.5 (-1.12)
Intended percentage	0.03 (1.04)	0.03 (1.06)	0.03 (1.04)	0.04 (1.11)	0.04 (1.07)
Leverage	-2.77 (-1.49)	-2.75 (-1.48)	-2.74 (-1.47)	-2.53 (-1.36)	-2.68 (-1.44)
Tobin's Q	0.32** (2.13)	0.32** (2.14)	0.32** (2.11)	0.32** (2.11)	0.32** (2.14)
Cash	0.04** (1.96)	0.04** (2)	0.04** (1.96)	0.04** (2.05)	0.04** (2.01)
Cash flow	0.06* (1.88)	0.06* (1.85)	0.06* (1.89)	0.07* (1.91)	0.06* (1.89)
Research & Dev. Expense	0.03	0.03	0.03	0.02	0.02

	(0.37)	(0.37)	(0.36)	(0.27)	(0.33)
CAPEX	-0.01	-0.01	-0.01	-0.01	-0.01
	(-0.23)	(-0.21)	(-0.23)	(-0.17)	(-0.21)
Return volatility	-9.34	-8.62	-8.15	-4.19	-8.43
	(-0.35)	(-0.33)	(-0.31)	(-0.16)	(-0.32)
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
R-squared	0.06	0.06	0.06	0.07	0.06
Observations	8786	8786	8786	8786	8786

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Table 7: Post-announcement trades and long-term returns

This table reports mean long-term returns for subgroups of repurchase-announcing firms by post-announcement net insider sales. Firms are ranked based on 1-month net insider sales after the repurchase announcement. The difference (Diff) column reports the difference in mean returns between firms in high and low subgroups. The t-test is used to test whether the difference in means is statistically different from zero. 2 (3)-year BHAR is the two- (three-) year buy-and-hold abnormal return of repurchase-announcing firms using value weighted market return as the benchmark. The lower panel sorts firms into subgroups by considering CEO and CFO trades only.

Variables	Post 1-Month net insider sales			P-value
	high	low	Diff	
2 year BHAR	0.073	0.110	-0.037**	0.024
3 year BHAR	0.124	0.170	-0.047**	0.034
CEO and CFO trades				
2 year BHAR	0.044	0.104	-0.06**	0.022
3 year BHAR	0.114	0.161	-0.047	0.205

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Table 8: Direction of post-announcement insider trades and long-term returns

Table 8 reports mean long-term returns for subsamples of firms based on the direction of insider trade in the one-month period following the repurchase announcement. P-only, Mix and S-only subsamples include firms with insider purchase-only, mix (bi-directional) and sales-only transactions, respectively. Firms with no insider trades are included in the mix subgroup. P-S reports the mean difference in returns between firms in the purchase-only and sale-only subgroups. P-M reports the mean difference in returns between firms in the purchase-only and mix subgroups. M-S reports the mean difference in returns between firms in the mix and sale-only subgroups. The t-test is used to test whether the difference in means is statistically different from zero.

Variables	P-only	Mix	S-only	P-S	P-M	M-S
2 year BHAR	0.116	0.109	0.064	0.052**	0.007	0.045**
3 year BHAR	0.2	0.165	0.11	0.09**	0.035	0.055**

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and * respectively.

Table 9: Pre- and post-announcement insider trades and long-term returns

This table reports mean long-term returns for subgroups of repurchase-announcing firms classified by net insider sales around the repurchase announcement. The high (low) subgroup contain firms with high (low) net insider sales in the pre-announcement as well as high (low) net insider sales in the post-announcement period. Firms are ranked into high and low groups based on 1-month net insider sales around the repurchase announcement. The difference (Diff) column reports mean differences in returns between high and low subgroups. The t-test is used to test whether the difference in means is statistically different from zero. P-values associated with the t-statistic are reported in the table. Variables are as defined in tables 2 and 7.

Variables	1-month net sales around repurchase announcement.			P-value
	High	Low	Diff	
2-year BHAR	0.043	0.112	-0.069**	0.004
3-year BHAR	0.078	0.174	-0.096**	0.003

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Table 10: Long-term returns and insider trades

This table reports the results of regressions of long-term returns of repurchase-announcing firms on insider trades around the repurchase announcement. The dependent variable is the two-year buy-and-hold abnormal return after the repurchase announcement. Column 1 (2) regresses 2-year BHAR on 3 (1) -month high net insider sales dummy, which is equal to 1 when a firm is in the high net insider sales subgroup based on 3 (1) month post-announcement insider trades and 0 otherwise. High net sales dummy (pre&post) is a dummy variable equal to 1 when the repurchase announcing firm is in the high net insider sales subgroup in both the pre- and post-announcement periods and 0 otherwise. The dummy variable in columns 1 and 3 is based on net insider trades in the 3-month period around the repurchase announcement, whereas in columns 2 and 4 it is based on the 1-month net insider trades around the repurchase announcement. The t-statistics are reported in parenthesis after adjusting standard errors for heteroskedasticity as suggested by White (1980). Year and industry fixed-effects are included in all regression models. Other control variables are as defined in table 2.

	Post-ann.		Pre and post	
	3m	1m	3m	1m
Intercept	-0.54*** (-3.13)	-0.54*** (-3.14)	-0.54*** (-3.13)	-0.54*** (-3.12)
high net sales dummy (3-month)	-0.02 (-1.15)			
high net sales dummy (1-month)		-0.04* (-1.92)		
high net sales dummy (pre&post)			-0.02* (-1.7)	
high net sales dummy (pre&post)				-0.03** (-2.41)
Announcement return	0.16 (1.48)	0.17 (1.56)	0.15 (1.44)	0.16 (1.5)
Stock price run-up	0.02 (0.44)	0.03 (0.55)	0.02 (0.43)	0.03 (0.64)
Book to-market ratio	0.11*** (4.49)	0.11*** (4.47)	0.11*** (4.36)	0.11*** (4.42)
Size	0.05*** (3.78)	0.05*** (3.9)	0.05*** (3.94)	0.05*** (4.04)
Intended percentage	0.00 (0.31)	0.00 (0.33)	0.00 (0.32)	0.00 (0.32)
Leverage	0.27*** (5.1)	0.26*** (5.07)	0.26*** (5.01)	0.26*** (4.99)
Tobin's Q	-0.01*** (-3.47)	-0.01*** (-3.43)	-0.01*** (-3.42)	-0.01*** (-3.34)
Cash	0.21*** (3.48)	0.21*** (3.5)	0.21*** (3.5)	0.21*** (3.52)
Cash flow	0.85*** (8.93)	0.84*** (8.93)	0.85*** (8.98)	0.01*** (8.97)
Research & Dev. Expense	1.61*** (7.9)	1.61*** (7.91)	1.62*** (7.93)	1.62*** (7.92)

CAPEX	-0.8*** (-4.61)	-0.8*** (-4.63)	-0.8*** (-4.62)	-0.8*** (-4.63)
Return volatility	4.69*** (6.85)	4.67*** (6.82)	4.69*** (6.84)	4.7*** (6.87)
Year FE	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y
R-squared	0.0295	0.0298	0.0297	0.030

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Table 11: Actual repurchases and insider trades

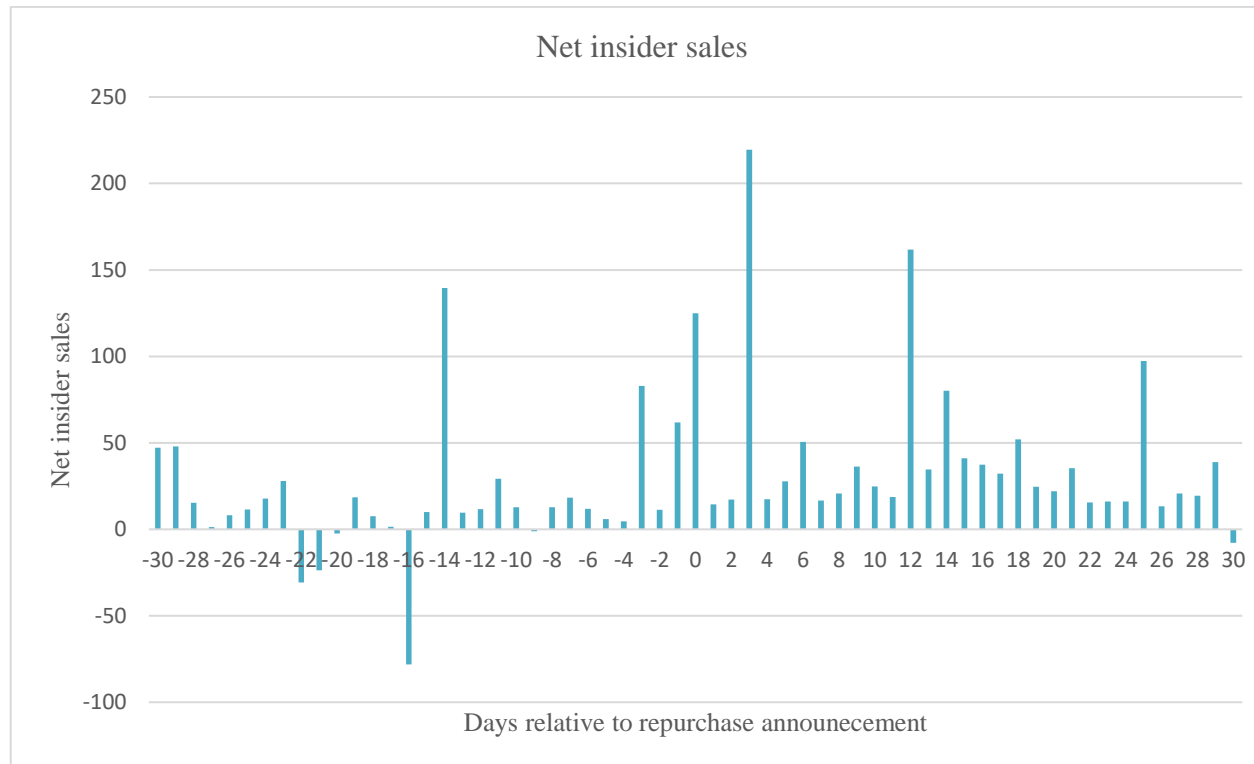
This table reports the results of regressions of *actual* firm repurchases on insider trades around the repurchase announcement. The dependent variable is the actual repurchase completion rate, defined as the percentage of outstanding shares actually repurchased by the firm in the one year period following the repurchase announcement scaled by the intended repurchase program size (in percentage) at the time of repurchase announcement. Pre- (post-) ann. refers to insider trades in the pre- (post-) announcement periods respectively. 3m and 1m refer to 3-month and 1-month trading windows around the repurchase announcement respectively. Net sales is the net sales by all firm insiders in a given time window around the repurchase announcement. The CEO and CFO net sales indicate net sales by the CEO and CFO only. Other insiders' net sales measure net sales by all firm insiders except the CEO and CFO. Other variables are as defined in table 2 and 4. The t-statistics are reported in parenthesis after adjusting standard errors for heteroskedasticity as suggested by White (1980). Regression models include industry and year fixed-effects.

		post-ann.				pre and post ann.	
		1m		3m		3m	
Intercept		1.05*** (6.64)	1.05*** (6.63)	1.05*** (6.61)	1.06*** (6.69)	1.05*** (6.61)	1.06*** (6.7)
Pre-ann.	Net sales					0.62 (0.47)	
	CEO&CFO net sales						5.64 (0.62)
	Other Insiders' net sales						0.65 (0.4)
Post-ann.	Net sales	9*** (3.32)		5.74*** (5.08)		5.64*** (4.91)	
	CEO&CFO net sales		-82.67*** (-3.54)		-28.81*** (-3.01)		-30.29*** (-3.1)
	Other Insiders' net sales		14*** (4.51)		7.66*** (6.09)		7.56*** (5.9)
Stock price run-up		-0.12*** (-2.78)	-0.11*** (-2.59)	-0.12*** (-2.86)	-0.12*** (-2.66)	-0.12*** (-2.84)	-0.11*** (-2.63)
BHAR 1 year		-0.08***	-0.08***	-0.08***	-0.08***	-0.08***	-0.08***

	(-4.92)	(-4.99)	(-5.01)	(-5.04)	(-5)	(-5.01)
Return volatility	-2.78*** (-4.45)	-2.78*** (-4.45)	-2.81*** (-4.51)	-2.8*** (-4.48)	-2.82*** (-4.51)	-2.8*** (-4.49)
Cash	0.15*** (2.67)	0.15*** (2.74)	0.15*** (2.67)	0.15*** (2.74)	0.15*** (2.64)	0.15*** (2.68)
Cash Flow	0.10 (1.1)	0.11 (1.22)	0.09 (1)	0.10 (1.12)	0.08 (0.96)	0.09 (1.04)
CAPEX	-0.54*** (-3.42)	-0.55*** (-3.5)	-0.53*** (-3.37)	-0.55*** (-3.45)	-0.53*** (-3.37)	-0.55*** (-3.44)
Research & Dev. Expense	-0.51*** (-2.72)	-0.5*** (-2.69)	-0.53*** (-2.81)	-0.53*** (-2.82)	-0.53*** (-2.8)	-0.53*** (-2.81)
Intended percentage	-0.02*** (-17.75)	-0.02*** (-17.77)	-0.02*** (-17.85)	-0.02*** (-17.77)	-0.02*** (-17.85)	-0.02*** (-17.78)
Leverage	-0.08 (-1.64)	-0.08* (-1.67)	-0.07 (-1.62)	-0.08 (-1.65)	-0.07 (-1.62)	-0.08 (-1.65)
Tobin's Q	0.01** (1.99)	0.01** (2.04)	0.01** (1.99)	0.01** (2.03)	0.01** (1.98)	0.01** (2.03)
Size	0.01 (1.21)	0.01 (1.32)	0.01 (1.28)	0.01 (1.35)	0.01 (1.28)	0.01 (1.32)
Book to-market ratio	0.13*** (5.47)	0.13*** (5.39)	0.13*** (5.54)	0.13*** (5.39)	0.13*** (5.55)	0.13*** (5.42)
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
R-squared	0.052	0.054	0.053	0.055	0.053	0.055

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Figure 2: Net insider sales relative to repurchase announcement day



Unreported results

Table I: Pre-announcement net insider sales and returns of repurchasing firms

The table shows mean short-term and long-term returns of repurchase announcing firms by high and low net insider sales in the pre-announcement period. 3-month net sales is the difference between the number of firms' shares sold and the number of firms' shares bought by insiders in the 3 month period before the repurchase announcement. This difference is then normalized by number of outstanding shares and multiplied by 10,000. 3-day BHAR is the 3 day (-1,1) buy-and-hold abnormal return around the event date (day 0). 3-day CAR is the three day cumulative abnormal return around the event date (-1,1). 5-day BHAR is the 5 day (-2, 2) buy-and-hold abnormal return around the event date (day 0). 1st year BHAR is the 1 year (12 months) buy-and-hold abnormal return post-announcement where value weighted return on the market is used as the benchmark. 2nd year BHAR is the post-announcement second year (13-24 months) buy-and-hold abnormal return starting after the first anniversary month of the repurchase announcement. 2 year BHAR is the 2 year (24 months) buy-and-hold abnormal return of repurchase announcing firms starting from the month of the repurchase announcement where the benchmark return is the value weighted return on the market. High (low) columns report mean returns for firms with pre-announcement net sales above (below) the mean value of net insider sales. The difference (Diff) column reports mean return difference between high and low pre-announcement net insider sales firms. T-test is used to test the significance of the difference from zero. P-values associated with the t-test are reported in the table.

Variables	3-Month net sales (pre-ann.)			P-value
	High	Low	Diff	
3-day BHAR	0.016	0.024	-0.008***	0.0001
3-day CAR	0.017	0.026	-0.009***	0.0001
5-day BHAR	0.013	0.024	-0.011***	0.0001
1 st year BHAR	0.048	0.039	0.009	0.5386
2 nd year BHAR	0.060	0.069	-0.004	0.5106
2-year BHAR	0.099	0.100	-0.001	0.9501

Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Table II: Direction of pre-announcement insider trades and returns of repurchasing firms

The table reports mean returns by subsamples based on direction of insider trades in the three-month window before the repurchase announcement. P only sub sample include firms with insider purchase only transaction during the period. Mix sub sample reports mean returns for firms with both purchase and sale transactions during the period. Firms with no insider trades are also included in this group. S only sub sample report mean returns for firms with insider sale only transactions during the period. P-S reports mean difference in returns between firms with purchase only and sale only transactions. P-M reports mean difference in returns between firms with purchase only and mix transactions. M-S reports mean difference in returns between firms with mix and sale only transactions. T-test is used to test these differences in returns are significantly different from zero.

	P-only	Mix	S-only	P-S	P-M	M-S
3-day BHAR	0.033	0.025	0.013	0.02***	0.008***	0.012***
3-day CAR	0.035	0.027	0.015	0.02***	0.008***	0.012***
5-day BHAR	0.035	0.025	0.010	0.025***	0.01***	0.015***
1st year BHAR	0.065	0.031	0.042	0.023	0.034**	-0.011
2nd year BHAR	0.077	0.071	0.057	0.020	0.006	0.014
2 year BHAR	0.133	0.096	0.088	0.045**	0.037*	0.008

Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.